CLINICAL SCIENCE

Role of psychiatric disorders and irritable bowel syndrome in asthma patients

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OBJECTIVES: The goals of the study were the following: 1) to determine the frequency of psychiatric disorders and irritable bowel syndrome in patients with asthma and 2) to compare the frequency of these disorders in patients with asthma to their frequency in healthy controls.

INTRODUCTION: Patients with asthma have a higher frequency of irritable bowel syndrome and psychiatric disorders.

METHODS: We evaluated 101 patients with bronchial asthma and 67 healthy subjects. All subjects completed the brief version of the Bowel Symptoms Questionnaire and a structured clinical interview for DSM-IV axis disorders (SCID-I/CV).

RESULTS: There were 37 cases of irritable bowel syndrome in the group of 101 stable asthma patients (36.6%) and 12 cases in the group of 67 healthy subjects (17.9%) ($p = 0.009$). Irritable bowel syndrome comorbidity was not related to the severity of asthma ($p = 0.15$). Regardless of the presence of irritable bowel syndrome, psychiatric disorders in asthma patients (52/97; 53.6%) were more common than in the control group (22/63, 34.9%) ($p = 0.02$). Although psychiatric disorders were more common in asthma patients with irritable bowel syndrome (21/35, 60%) than in those without irritable bowel syndrome (31/62, 50%), the difference was not significant ($p = 0.34$). In asthma patients with irritable bowel syndrome and psychiatric disorders, the percentage of forced expiratory volume in 1 s (FEV_1) was lower than it was in those with no comorbidities ($p = 0.02$).

CONCLUSIONS: Both irritable bowel syndrome and psychiatric disorders were more common in asthma patients than in healthy controls. Psychiatric disorders were more common in asthma patients with irritable bowel syndrome than in those without irritable bowel syndrome, although the differences failed to reach statistical significance. In asthma patients with IBS and psychiatric disorders, FEV_1s were significantly lower than in other asthma patients. It is important for clinicians to accurately recognize that these comorbid conditions are associated with additive functional impairment.

KEYWORDS: Asthma; Irritable bowel syndrome; DSM-IV; Psychiatric disorders; Rome II criteria; Depression.

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INTRODUCTION

Asthma is a serious public health problem worldwide, with an estimated 300 million affected individuals. Asthma is a chronic inflammatory disorder of the airways with symptoms that include recurring episodes of wheezing, breathlessness and cough. When uncontrolled, asthma can impose severe limits on daily life, and it is sometimes fatal. The frequency of asthma is increasing in most countries. It appears that the global frequency of asthma ranges between 1% and 18% of the population in different countries.[1] Reported comorbidities include gastrointestinal disturbances.[2]

Irritable bowel syndrome (IBS) is a chronic functional gastrointestinal (GI) disorder that affects 10–15% of the population and has a higher frequency in women and a variable frequency in different populations.[3] As outlined by the Rome II criteria, IBS is defined as persistent pain or discomfort that is associated with two of the following three criteria: symptomatic relief with defecation, looser stools

with more frequent bowel movements or harder stools with rarer bowel movements. The Rome II criteria require the presence of these symptoms for 12 weeks of the previous 12 months for establishment of a diagnosis.[4] In patients with IBS, bowel habits are altered (constipation and/or diarrhea) with the absence of any apparent mechanical, biochemical or inflammatory changes in the gastrointestinal tract.

The relationship between bronchopulmonary disorders and IBS was first suspected in 1991 when White et al. demonstrated a higher frequency of bronchial hyperresponsiveness in patients with IBS.[5] Later, several studies reported an association between IBS and asthma.[6-8]

Curiously, psychiatric disorders, particularly depressive and anxiety disorders, have been shown to be significantly more prevalent in asthma patients than in the general population.[9-11]

Diseases of the digestive tract frequently coexist with psychological disorders. Among referred patients with IBS, psychiatric disorders have also been reported to be very common, leading to the argument that IBS is a part of the psychiatric disease spectrum and not a unique condition.[12]

To our knowledge, no studies investigating the presence of psychiatric diagnoses in asthma patients with and without IBS have been cited in the previous literature.

The current study's goals were as follows: 1) to determine the frequency of IBS, 2) to reveal the frequency of psychiatric disorders using a structured clinical interview for DSM-IV axis disorders (SCID-I/CV) in asthma patients, and 3) to compare these frequencies in asthma patients to those in controls without asthma.

MATERIALS AND METHODS

Study Design

We evaluated 101 consecutive patients with stable bronchial asthma as defined by the Global Initiative for Asthma (GINA) guidelines (1) and 67 healthy subjects who were referred to the Gaziosmanpasa University Medical Faculty Research and Training Hospital between June 2006 and December 2009. This was a sectional, descriptive study. The demographic features (age, gender, smoking status, education, occupation), disease durations, respiratory symptoms and clinical examination findings were recorded. Pulmonary function tests were performed for each subject by the same technician using the Jaeger Master Screen Pneumo device. Asthma patients were separated into two groups in this study. Group 1 included asthma patients with IBS, and group 2 included asthma patients without IBS. The frequencies of IBS and psychiatric disorders were determined for all asthma patients, in subgroups of asthma patients and in control subjects.

The following patients and control subjects were excluded from the study: those with acute respiratory system infections, organic GI disease, a history of abdominal surgery, a pulmonary disease other than asthma, cardiovascular disease or any other systemic diseases such as diabetes mellitus, thyroid and renal disorders, chronic inflammatory diseases such as rheumatoid arthritis and scleroderma, or uncontrolled hypertension. Pregnant and puerperal women, patients using drugs affecting smooth muscle and the autonomic nervous system, and patients experiencing acute asthma attacks were also excluded. Other exclusion criteria were the current use of any medications for a psychiatric disorder and the presence of any organic disorders that might affect the psychiatric assessment. To prevent any bias and side effects of medications, we excluded asthma patients who were hospitalized or discharged from the hospital in the last year. No patients received IV, nebulized, or oral β_2-agonists, IV aminophylline, oral/parenteral corticosteroids, or immunosuppressive therapy during the study or in the six months leading up to it. Patients also had to be exacerbation-free during this period. Control healthy subjects were recruited from the hospital or university staff. They had no history of asthma and no respiratory complaints. Four of the asthma patients and two healthy control subjects were excluded from the study. Current usage of psychiatric medicine might affect and make psychiatric assessment difficult, so we excluded people taking psychiatric medicine from the study. Only patients who answered all questions were included.

Written informed consent was obtained from the subjects after they were told about the design, aim and details of the cross-sectional study. The study conformed to the Declaration of Helsinki.

The assessment of asthma and its severity

Diagnosis of asthma was based on clinical history, the forced expiratory volume in first second FEV_1, or peak expiratory flow >15% and diurnal variations of peak expiratory flow rate >20% according to GINA (The Global Initiative for Asthma) criteria.[1] Pulmonary function tests were performed using a calibrated flow sensor spirometer (Model D-97204 Jaeger Toennies; Type. APS-Pro; Hoechberg, Germany) according to the European Respiratory Society Standardization.[13] The best of three reproducible loops was selected for the study. The principal endpoint was the estimated value of FEV_1. In addition, the forced vital capacity (FVC) and the ratio of FEV_1/FVC were recorded. According to the spirometry results, clinical asthma symptomatology and usage of medications, especially inhaled corticosteroids, asthma patients were classified into 4 groups for their asthma severity according to GINA: mild intermittent, mild persistent, moderate persistent and severe persistent.

The assessment of IBS

The brief version of the Bowel Symptoms Questionnaire (BSQ) was used to assess the Rome II criteria and general GI symptomatology.[14] In particular, the first four questions of the BSQ were used to assess the symptoms that were consistent with a diagnosis of IBS. These questions included (1) ''In the past three months, have you had continuous or repeated discomfort or pain in your lower abdomen (If you are female, this should not be related to your menstrual cycle or period)?'' (1a) ''Is this discomfort or pain typically relieved by a bowel movement?'' (1b) ''Is this discomfort or pain typically associated with a change in the frequency of bowel movements (i.e., having more or fewer bowel movements a day)?'' (1c) ''Is this discomfort typically associated with a change in the consistency of the stool (i.e., softer or harder)?'' An additional question was incorporated in to the BSQ to better assess the Rome-II criteria, which included the Rome-II time course criteria, that is, symptoms in at least 12 weeks of the previous 12 months. The BSQ is a previously validated, self-report instrument used to measure gastrointestinal symptoms. Diagnosis of IBS was based on Rome II criteria.

Table 1 - Sociodemographic data.

	Asthma patients (n = 98)	Control subjects (n = 65)	X^2	p	t
Age (yrs)	42.87 ± 11.73	40.47 ± 11.25		0.19	1.29
Sex					
female	75 (76.5%)	48 (73.8%)	0.152	0.697	
male	23 (23.5%)	17 (26.2%)			
Education					
illiterate	1 (1%)	1 (1.5%)	37.82	0.0001	
literate	3 (3%)	3 (4.6%)			
primary education	63 (65.6%)	11 (16.9%)			
high school	11 (11.5%)	16 (24.6%)			
higher education	18 (18.8%)	34 (52.3%)			
Occupation					
retired	9 (9.2%)	4 (6.2%)	21.83	0.003	
housewife	55 (56.1%)	22 (33.8%)			
worker	6 (6.1%)	10 (15.4%)			
employee	15 (15.3%)	24 (36.9%)			
out of work	2 (2.0%)	1 (1.5%)			
student	3 (3.1%)	-			
free	3 (3.1%)	4 (6.2%)			
farmer	5 (5.1%)	-			
Smoking history					
nonsmoker	74 (75.5%)	41 (63.1%)	3.70	0.15	
ex-smoker	12 (12.2%)	9 (13.8%)			
current smoker	12 (12.2%)	15 (23.1%)			
Severity of Asthma		-		-	
Intermittent asthma	2 (2%)				
Persistent asthma					
mild	63 (62.4%)				
moderate	31 (30.7%)				
severe	5 (5%)				

$p<0.05$: significant.

The assessment of psychiatric diagnoses

Asthma patients and control subjects were evaluated for psychiatric diagnoses in the psychiatry department using a semi-structured sociodemographic information form and they were evaluated for DSM-IV axis I disorders using a structured clinical interview (SCID-I/CV)[15] in the Turkish version.[16]

Statistical Analyses

For statistical comparisons of qualitative parameters, chi-square and Fisher's exact tests were used. For measurable categorical variables, tests for significant differences between two means and one-way analyses of variance (ANOVAs) were utilized. $P<0.05$ was considered significant.

RESULTS

One hundred and one subjects with stable, bronchial asthma (77 women, 24 men) and 67 healthy subjects (49 women and 18 men) were included in the study. The mean ages were 42.87 ± 11.73 yrs and 40.47 ± 11.25 yrs for the asthma and control groups, respectively (p = 0.19, t: 1.29). The demographic and clinical features of the asthma patients and the control subjects with and without IBS are shown in Table 1.

There were 37 IBS cases among 101 patients with stable bronchial asthma (36.6%) and 12 IBS patients among 67 healthy subjects (17.9%). The frequency of IBS was significantly higher in asthma patients than in healthy individuals (36.6% and 17.9%, respectively; p = 0.009) (Table 2). For all subjects studied, the frequency of IBS was not significantly different between females and males (p = 0.38) (Table 3). IBS comorbidity was not correlated with age, gender, occupation, level of education, smoking status, or severity of asthma (respectively, p = 0.39, p = 0.38, p = 0.55, p = 0.56, p = 0.66, p = 0.15) (Table 4). The frequency of IBS comorbidity was not significantly different when considering FEV_1 and FEV_1/FVC ratios. When Group 1 and Group 2 were compared, the differences between the means were not significant (FEV_1: 89.88 ± 17.29, and 95.87 ± 13.75, t:1.90, p = 0.06; FEV_1/FVC: 77.97 ± 10.48, and 77.46 ± 7.29, t:-.28, p = 0.77, respectively) (Table 5).

Regardless of the presence of IBS, psychiatric disorders were more common in asthma patients than in the control subjects (52/97, 53.6%, and 22/63, 34.9%, respectively; p = 0.02) (Table 2). Psychiatric diagnoses made in the patient

Table 2 - The frequency of IBS and psychiatric disorders in asthma patients and control subjects.

	Asthma patients (n = 101)	Control subjects (n = 67)	χ^2	p
IBS comorbidity	37 (36.6%)	12 (17.9%)	6.835	0.009*
	Asthma patients (n = 97)	Control subjects (n = 63)		
Psychiatric disorders	52 (53.6%)	22 (34.9%)	5.36	0.02*

IBS: irritable bowel syndrome.
*$p<0.05$ = significant.

Table 3 - The distribution of IBS comorbidity and psychiatric disorders according to gender.

	Female	Male	χ^2	p
IBS comorbidity	n = 77 30	n = 24 7	0.75	0.38
Psychiatric disorders	n = 74 37 (50%)	n = 23 15 (65.2%)	1.63	0.20

IBS: irritable bowel syndrome.

group and the control group and the intergroup comparisons of diagnoses are shown in Table 6. Although psychiatric disorders were more common in Group 1 (21/35, 60%) than in Group 2 (31/62, 50%), the difference was not statistically significant (p = 0.34) (Table 7). Twenty asthma patients had IBS comorbidities together with psychiatric disorders, while 31 asthma patients did not. There was a statistically significant difference between the two patient groups with respect to the forced expiratory volume in 1 s (t: 2.41, p = 0.02). There was no statistical difference between the two patient groups in terms of the ratio of the FEV_1/FVC (t: 0.14, p = 0.8).

The comorbidities of psychiatric disorders were not related to age, gender, occupation, educational status, smoking history, or duration or severity of asthma (p = 0.89, p = 0.20, p = 0.61, p = 0.59, p = 0.43, p = 0.54, and p = 0.07, respectively) (Table 4 and 8). There were no differences for the FEV_1 or FEV_1/FVC ratio in asthma patients with and without psychiatric disorders (FEV_1: 91.31 ± 15.80, and 96.35 ± 14.89, p = 0.11; FEV_1/FVC: 77.23 ± 9.26, and 78.35 ± 7.92, p = 0.52, respectively) (Table 5).

Table 4 - Statistical data of the distribution of IBS comorbidity and psychiatric disorders according to sociodemographic data, clinical data and respiratory function tests for asthma patients.

	IBS comorbidity			Psychiatric disorders		
	χ^2	p	t	χ^2	p	t
Age		0.39	0.85		0.89	0.13
Gender	0.75	0.38		1.63	0.20	
Education	2.93	0.56		2.75	0.59	
Occupation	5.85	0.55		5.38	0.61	
Smoking history		0.66	0.43		0.43	0.77
Duration of asthma		0.10	1.63		0.54	0.61
FEV_1	0.06	1.90			0.11	1.60
FEV_1/FVC	0.77	0.28			0.52	0.63
Severity of asthma	5.31	0.15		6.79	0.07	

FEV_1: Forced expiratory volume in one second.
FEV_1/FVC: Ratio of forced expiratory volume in 1 s-to-forced vital capacity both expressed in percentages.

DISCUSSION

To our knowledge, this study is the first to investigate different psychiatric diagnoses in asthma patients with and without IBS. It is important for clinicians to accurately recognize the linkage between psychiatric diagnoses, asthma and IBS because these comorbid conditions are associated with increased asthma symptom burden and additive functional impairment.[17]

Kennedy et al.[18] showed that IBS, gastroesophageal reflux symptoms, and symptomatic bronchial hyperreactivity occurred more frequently than expected and that the conditions were independently associated with each other. Symptoms of patients with diagnoses of asthma and IBS overlap considerably. These associations are difficult to explain. One possible explanation is that the gastrointestinal and respiratory symptoms in our subjects are caused by a common (but as yet unidentified) underlying disorder capable of producing symptoms in more than one physiological system and resulting in an indirect association between seemingly disparate conditions. A number of candidate mechanisms accounting for this association exist. A generalized disorder involving bronchial, gastrointestinal, and smooth muscles might be implicated in this association. A more complex neuromuscular disorder with altered visceral sensitivity and shared transmitter dysfunction is another possible suggestion. Another possibility is the presence of an underlying inflammatory etiology leading to respiratory and gastrointestinal symptoms. In IBS, evidence related to colonic inflammation comprising infiltrates of lymphocytes and mast cells has been documented.[19,20] A correlation was found between markers of inflammation and major depressive disorder.[21] Increased fibrinogen, myeloperoxidase and ferritin and decreased transferrin serum levels have been found to be related to major depressive disorder.[21]

Huerta and et al.[7] found that there was a slightly increased risk of IBS in asthma patients compared with the general population and that the risk of IBS was reduced by the use of oral steroids in asthma patients. In our study, the patients had not used oral steroids in the last 6 months. Yazar et al.[8] studied 133 patients with IBS and showed that 15.8% of them had bronchial asthma according to history, clinical, and pulmoner function test findings. There were 45 (33.8%) and 8 (5.8%) subjects with respiratory symptoms in the IBS and control groups, respectively (p<0.0001).[8] In another study conducted in patients 60 years of age (aged 45.1 ± 14.9 years), Roussos et al.[6] reported that the prevalence of IBS was significantly higher in asthmatics (62/150, 41.3%) than in subjects with other pulmonary disorders (29/130, 22.3%) and in age-matched healthy controls (25/120, 20.8%, p<0.001). Similarly, the frequency of IBS in asthma patients and healthy controls was 36.6% and 17.9%, respectively, in our study. Ekici et al.[22] showed that the prevalence of IBS in the stable asthmatic group ((n = 65 young (age <60 years) and 66 elderly (age>or = 60 years)) was higher than that in the control group (119 age-matched healthy volunteers (27.5% versus 16.8%, p = 0.04). The prevalence of IBS was significantly higher in young asthmatics than in age-matched healthy controls (36.9% versus 20.3%, p = 0.04) and elderly asthmatics (36.9% versus 18.2%, p = 0.01).[22] In our study, the frequency of IBS was similar to that observed in the previous studies, and the asthma patients' mean age was 42. Epidemiological studies suggest that the frequency of IBS declines with age, and symptoms of IBS might change and disappear in the elderly population as time passes, possibly because of alterations in the perception of pain. However, very little research into the risk factors, diagnosis and treatment of IBS in the elderly has been performed.[23] Ekici et al. applied logistic regression analysis to identify younger age (odds ratio, 2.1 [1.1-3.8]; p = 0.01) as an independent risk factor for IBS.[22] In our

Table 5 - The distribution of IBS comorbidity and psychiatric disorders according to FEV_1, FEV_1/FVC parameters.

	Group 1	Group 2	p	t
FEV_1	89.88 ± 17.29	95.87 ± 13.75	0.06	1.90
FEV_1/FVC	Group 1	Group 2	0.77	0.28
	77.97 ± 10.48	77.46 ± 0.91		
FEV_1	Asthma patients with psychiatric disorders	Asthma patients without psychiatric disorders	0.11	1.60
	91.31 ± 15.80	96.35 ± 14.89		
FEV_1/FVC	Asthma patients with psychiatric disorders	Asthma patients without psychiatric disorders	0.52	0.63
	77.23 ± 9.26	78.35 ± 7.92		
FEV_1	Asthma patients with IBS and psychiatric disorders	Asthma patients without IBS and psychiatric disorders	0.02*	2.41
	86.25 ± 17.35	96.87 ± 13.96		
FEV_1/FVC	Asthma patients with IBS and psychiatric disorders	Asthma patients without IBS and psychiatric disorders	0.88	0.14
	78.45 ± 12.06	78.83 ± 7.52		

FEV_1: Forced expiratory volume in one second, **FVC**: Forced vital capacity.
FEV_1/FVC: Ratio of forced expiratory volume in 1 s to forced vital capacity, both expressed in percentages.
Group 1: Asthma patients with IBS.
Group 2: Asthma patients without IBS.
IBS: Irritable bowel syndrome.
All values are presented as the mean ± SD.
*$p<0.05$ = significant.

study, we could not find any correlation between IBS and patient age.

Ozol et al.[23] found that although the rate of IBS was higher in moderate and severe persistent asthma patients than in mild persistent asthma patients, the difference was not significant. In our study, the rate of IBS was similar for all groups. Roussos et al. showed a lack of statistically significant difference in spirometric values between asthmatic patients with IBS (FEV_1/FVC: 64.9 ± 11.6) and those without IBS (FEV_1/FVC: 65.7 ± 12.2, $p>0.05$).[6] Likewise, Ekici et al.[22] found no statistically significant difference in spirometric values between asthma patients with IBS and those without IBS (FEV_1/FVC: 82.3 ± 9.6 versus 80.9 ± 10.1, respectively, $p>0.05$). McCauley et al.[17] reported a similar degree of additive impairment based on having one and more anxiety or depressive disorders at each level of asthma severity. This finding suggests that this effect is not due to greater severity of asthma in youth with psychiatric disorders. In our study, we did not detect differences in the rates of comorbidities of psychiatric disorders and IBS for different levels of asthma severity in adult asthma patients, which is similar to the findings of the above-mentioned studies.

Some researchers have found correlations between depressive symptoms and decreased forced expiratory volume in 1 second (FEV_1) and FVC,[25] while other researchers have found no correlation between depressive symptoms and FEV_1 or bronchial hyperresponsiveness to a methacholine challenge.[26] It is possible that the stress related to anxiety and depressive disorders might trigger airway obstruction through physiologic mechanisms, resulting in more symptoms.[27] In our study, we also observed that the comorbidities of psychiatric disorders did not change as the severity of asthma state worsened. All of our patients' asthma was stable and they had not had asthma exacerbations in the past year.

Roussos et al.[6] showed that the prevalence of IBS is significantly higher in females (78/214, 36.4%) than in

Table 6 - The distribution of DSM-IV-TR diagnostic categories among Group 1 and Group 2 patients and control subjects.

	Group 1	Group 2	All asthma patients	Control subjects
	n = 35	n = 62	n = 99	n = 65
Depressive disorder	9 (42.9%)	17 (54.8%)	26 (50.0%)	10 (45.5%)
Anxiety disorder	5 (23.8%)	5 (16.1%)	10 (19.2%)	1 (4.5%)
Nicotine dependence	-	4 (12.9%)	4 (7.7%)	8 (36.4%)
Depersonalization disorder	-	-	-	-
Adjustment disorder	4 (19%)	4 (12.9%)	8 (15.4%)	3 (13.6%)
Somatoform disorder	3 (14.3%)	-	3 (5.8%)	-
Primary insomnia	-	1 (3.2%)	1 (1.9%)	-
All psychiatric disorders	21	31	52	22
Results	$\chi^2 = 0.90$	$p = 0.34$	$\chi^2 = 11.86$	$p = 0.03$*

Group 1: Asthma patients with IBS.
Group 2: Asthma patients without IBS.
IBS: Irritable bowel syndrome.
*$p<0.05$ = significant.

Table 7 - The frequency of psychiatric disorders in Group 1 and Group 2.

Psychiatric disorders	Group 1(n = 35)	Group 2 (n = 62)	χ^2	p
	21 (60%)	31 (50%)	0.90	0.34

Group 1: Asthma patients with IBS.
Group 2: Asthma patients without IBS.
IBS: irritable bowel syndrome.

males (38/186, 20.4%, $p<0.001$) in asthma patients and control subjects. Similarly, Yazar and Celebi et al. found that IBS is more common in females than in males.[8,28] No associations between IBS and gender were found in our study.

The frequency of IBS was highest (10.2%) in persons who were illiterate and lowest (3.0%) in university graduates. IBS was more prevalent in individuals with low educational and economic status.[28] In our study, we could not find any correlation between IBS and the educational level of the patients.

A recent epidemiologic study performed in children and adolescents 9 to 17 years of age reported that young people with a history of asthma were more likely to have an anxiety disorder, simple phobia, separation anxiety or an over-anxious disorder compared with controls.[29] In another study with 1,000 adult respondents, severe lifetime asthma was associated with an increased likelihood of panic disorder, social phobia, generalized and other types of anxiety, and bipolar disorder.[11] Katon et al.[30] suggested that there is an increased incidence in all types of anxiety and depressive disorders in youths with asthma (16.3%, all age 11-17 with asthma, n = 781) compared with controls (8.6%, n = 598). Youths with asthma have an almost two-fold higher prevalence of comorbid DSM-IV anxiety and depressive disorders compared with control youths. Those with ≥1 anxiety or depressive disorders were significantly more likely to be female, to have parents with less education, to have more medical comorbidities, to have a more recent diagnosis of asthma, and to be smoking.[30] In contrast to Katon et al., we did not find any association between psychiatric disorders and gender, education level, duration of asthma or smoking history. Additionally, we excluded asthma patients with medical comorbidities from our study. Furthermore, symptoms of anxiety (i.e., shortness of breath, tachycardia) and depressive disorders (i.e., insomnia, fatigue) may overlap with symptoms of asthma. Lavoie et al.[31] indicate higher rates of depressive and anxiety disorders among adult asthma patients. In our study, we also detected higher rates of psychiatric disorders, particularly depressive and anxiety disorders, in adult asthma patients, which is similar to the findings of the above-mentioned studies.

Using data from telephone interviews, McCauley et al.[17] reported that 125 children/adolescents (16.2%) met DSM-IV criteria for one or more anxiety and depressive disorders in the last 12 months, out of a sample of 767 young people aged 11 to 17 years with a documented diagnosis of and active treatment for asthma. In another study performed in asthma patients, Goodwin et al.[32] reported that approximately one in four (25.7%) pediatric asthma patients in an inner city asthma clinic met criteria for a probable diagnosis of a current anxiety disorder or depression (past 4-week prevalence).

IBS was consistently associated with mood and anxiety disorders. Mikocka-Walus searched for the association between IBS and psychiatric disorders. In their cross-sectional survey of 32 consecutive outpatients with clinically diagnosed IBS, 50% of the participants were anxious and 12% were depressed.[33] Gros et al. showed a high frequency of IBS symptoms in patients with panic disorder, generalized anxiety disorder, and major depressive disorder (n = 357). The rates of symptoms consistent with a diagnosis of comorbid IBS were found to vary based upon the principal diagnosis, with generalized anxiety disorder (25.8%), panic disorder (21.7%), and major depressive disorder (25%) demonstrating a higher frequency of comorbid IBS symptoms.[34] Ladep et al.[35] reported that 75 (56.8%) of 132 IBS patients were depressed, whereas only 54 (20.1%) of 268 non-IBS patients were depressed (n = 418). IBS patients were more likely to be depressed (odds ratio = 5.21, $p = 0.001$).

Although these are cross-sectional data limiting causal interpretation, prior studies have shown that anxiety and depressive disorders in patients with chronic illness (such as asthma and diabetes) are associated with a higher number of physical symptoms and greater functional impairment[17,36] even after controlling for severity of the relevant medical diseases.

Limitations of this study

One of the limitations of this study was the sample size. We used strict inclusion and exclusion criteria to exclude the effects of drugs, systemic disease and comorbid conditions to focus specifically on asthma. To prevent bias and side effects of medication, we excluded asthma patients who had been hospitalized or discharged from the hospital in the last year. For this reason, the number of patients was limited. We tried to take all suitable consecutive patients and controls to prevent bias.

CONCLUSIONS

We found that the frequencies of IBS and psychiatric disorders were higher in asthma patients than in members of the control group. Psychiatric disorders were more common in asthma patients with IBS than in those without

Table 8 - The distribution of IBS comorbidity and psychiatric disorders according to the severity of the asthma.

	Mild persistent asthma	Moderate persistent asthma	χ^2	p
Psychiatric disorders	n = 60 34 (56.7%)	n = 30 12 (40%)	6.79	0.07
IBS comorbidity	n = 63 19 (30.2%)	n = 31 15 (48.4%)	5.31	0.15

IBS: Irritable bowel syndrome.

it, but the difference was not statistically significant. In asthma patients with IBS and psychiatric disorders, FEV_1 values were significantly lower than in asthma patients without these disorders. Our findings suggest that it is important for clinicians to accurately recognize that these comorbid conditions are associated with additional functional impairment.

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